THE MONTHLY NEWS MAGAZINE OF THE NATIONAL BUREAU OF STANDARDS December 1976

DIMENSIONS NBS

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A PUBLICATION OF THE UNITED STATES DEPARTMENT OF COMMERCE

NATIONAL BUREAU OF STANDARDS

DIMENSIONS/NBS

DECEMBER 1976 / Vol. 60, No. 12 / ISSUED MONTHLY

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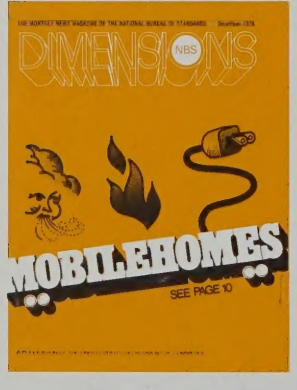
Nat. Bur. Stand. (U.S.) DIMENSIONS/NBS
CODEN:DNBSBG 60 (12) 1-24

Superintendent of Documents Catalog No. C13.13:60/12

Library of Congress Catalog No. 25-26527



Cover: The mobile home is getting increasing attention—from home buyers and from government. See the story beginning on page 10.

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Formerly the TECHNICAL NEWS BULLETIN of the National Bureau of Standards.
For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Annual subscription: Domestic, $9.45, foreign, $11.85, single copy, 80 cents. The Secretary of Commerce has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through June 30, 1981.

"AND PLEASE CHECK THE AIR"

by Michael Baum
NBS public information specialist

Problem: A large number of cars, probably more than one out of every four on the road, have at least one tire seriously underinflated. And even when drivers are aware of the need for properly inflated tires, the chances are that the air pumps they use will not deliver the proper pressure.
Solution: Educate the public on the importance of tire pressure and find a way to assure that the service station air pumps deliver the proper pressure on demand.
Method: Build a Gadget.

WHEN Peter Heydemann, chief of the National Bureau of Standards' Pressure and Vacuum Section, began to take a professional interest in how people inflate car tires, he started gathering figures on the economics of the problem.

"The statistics show that you can improve gas mileage by up to 1 mile per gallon if you inflate tires properly," he explains, "Now the average gas mileage in the U.S. is 13.7 miles per gallon, so a 1-mpg improvement could save about 7 percent of gasoline consumption. If this could be achieved on one out of every four cars, based on a total gasoline consumption of 6.6 million barrels a day in 1973, we could save at total of around 42 million barrels of gasoline a year."

Part of the problem, Heydemann notes, is getting drivers in the habit of checking their tires regularly. Organizations such as the Federal Energy Administration and the Tire Industry Safety Council recommend checking tire pressure at least once a month and adding an extra 3 or 4 pounds of pressure (not exceeding 32 psi) for long trips under heavy loads. One tire manufacturer has a national publicity campaign that

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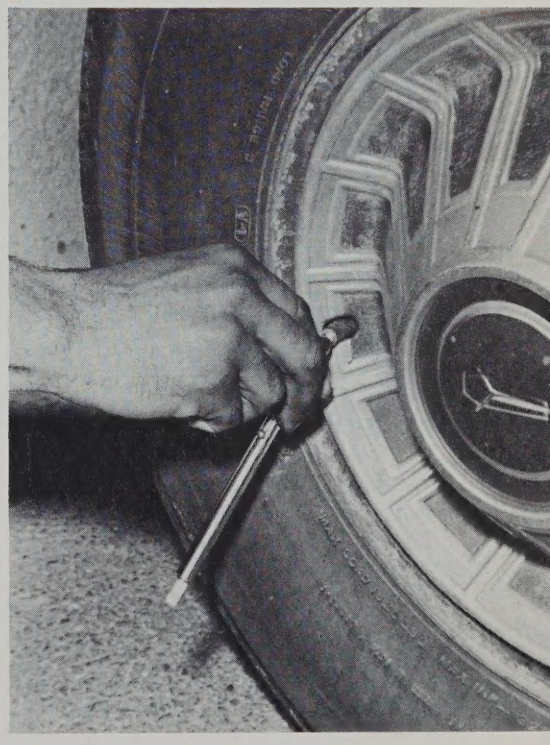
Tire pressures should be checked every few weeks, especially before long trips. Check the pressure when the tire is cold, before driving. Heat from driving can increase pressure by 6 psi or more.



(Photos by Larry Hale.)

spreads the word about underinflated tires. In random checks of cars in parking lots—admittedly not a scientific study—as many as 40 percent of the cars have underinflated tires.

Another study reported by NBS* in 1970 found that 28.4 percent of the cars tested had at least one tire at 20 psi or below—seriously underinflated.

In addition to decreasing gas mileage, underinflation also has a serious effect on the service life of automobile tires. The Tire Industry Safety Council estimates that underinflation by 4 to 10 psi cuts tread life from 10 to 40 percent.

Safe Driving

Some costs cannot be expressed in dollars and cents. Underinflated tires are dangerous, according to the Department of Transportation's National Highway Traffic Safety Administration. A survey of traffic accidents in northern Indiana over a three year period found that underinflated tires were the direct result of about 2 percent of the accidents.

In high-speed turnpike driving, the figure is probably higher. An underinflated tire bends more, straining the tire and overheating it, which can lead to blowouts. It also makes the car harder to handle on the road.

The problem of educating drivers to check tire pressues regularly is, Heydemann admits, not something that NBS can do much about. But the Pressure and Vacuum Section has another interest in the matter—the accuracy of the air columns at local filling stations.

*J. L. Harvey and F. C. Brenner. *Tire Use Survey: The Physical Condition, Use, and Performance of Passenger Car Tires in the United States of America*, NBS Technical Note 528, May 1970.

Air Tower Accuracy

The standard filling station air tower is familiar to every motorist. The support column holds an air pressure hose and an adjustable gage with a crank to set the gage to the desired pressure. The motorist drives up, sets the gage for, perhaps, 32 psi, and fills his tires with air until a bell in the gage stops ringing, indicating that the tire has reached a pressure of 32 psi.

The towers are notoriously inaccurate. A technical note issued by NBS in 1969* reported that a study of air towers in suburban Washington, D.C., showed that a motorist had about one chance in five of choosing an air tower that would fill his tires to within 1 psi of the figure on the gage. About 45 percent of the time, the driver could count on over or underinflating his tires by 3 psi or more by relying on the tower gage.

Fortunately, the study indicated, the problem was fairly simple to correct. Most of the gages tested differed uniformly up and down the scale, meaning that if the calibration was corrected for any one pressure, the gage would be equally accurate at other pressures.

Test Gadget

With that in mind, the Pressure and Vacuum Section set out to build a cheap, portable gadget that could be used to calibrate air towers. The resulting device, built by physicists James Hines and Vernon Bean, resembles a small suitcase and contains a pressure tank and a calibrated gage. It is accurate to within 0.5 psi.

*B. G. Simson and R. W. Radlinski. *The Accuracy of Air Tower Pressure Gages in Suburban Washington, D.C.*, NBS Technical Note 512, Dec., 1969.

The tank is connected to the air tower, filled to the nominal pressure shown on the tower's gage, and the test gage displays the actual pressure. Once pressurized, the tank can be used to test the accuracy of the hand-held tire pressure gages used in the service stations.

Hand-held gages are used by many service stations to check the accuracy of the air towers. Perhaps surprisingly, the hand gages are fairly accurate, according to Heydemann. Three years ago the Pressure and Vacuum Section began a free calibration service for tire gages, partially as a local community service and partially as a means of gathering information about the accuracy of such gages.

"We collected data over quite some time, about three-quarters of a year, and found that the tire gages are really pretty good, if they're clean," Heydemann reports. "Most of them are good to within a psi or so, if they're new, but if they get dirty they'll be off. You can overinflate, or more likely underinflate, tires by a large amount. There's no way to do anything about it, and, what's worse, no way of knowing it's wrong. There are no places in the country, outside of the manufacturers or here at NBS where the gages can be taken for calibration."

"Tire Gage Checker"

For that reason, the Section developed another side project, a "Tire Gage Checker" that could be set up as a display in public places where people could walk up and check the calibration of their hand-held gages at several different pressures.

"We dressed it up with buttons to push and flashing lights so that no red-blooded American could resist using it," said Heydemann. "The hope

is that once people calibrate their gages, they'll be curious enough to go home and check their tires.

Heydemann plans to exhibit the unit in several public places, rigged with a counter to record the number of times the calibration device is used. "If we can see that it attracts attention and people use it," he says, "then we hope to go to the Department of Transportation and see if they want to make a demonstration project out of it. The idea is to attack the educational part of the problem."

The next step for the portable pressure gage calibrator, says Heydemann, is to show the prototype model at one of the annual meetings of the National Conference on Weights and Measures, an organization of State and local weights and measures officials. Heydemann hopes that the officials will adopt the instrument, or something like it, for use by the state inspectors who check the accuracy of gasoline pump meters. Although most state weights and measures offices don't have the authority to require that air pumps be checked, says Heydemann, he feels that many service station operators will welcome a voluntary check of their air pressure gages.

Charles Binstead, executive director of the National Congress of Petroleum Retailers, agrees that although service station managers can always call the oil companies for maintenance of the air towers, they would probably like a periodic check of the gages' accuracy.

And, says Heydemann, cars in the future will rely on accurate pressure measurement for more than just tires. "Modern cars about three years from now will have a number of pressure transducers to run the car efficiently. They'll monitor half a dozen temperature and pressure measurements such as exhaust pressure, intake pressure, manifold pressure and the temperature at various points.

"That may be an incentive for the states to give their weights and measures officials the authority to check pressure measurement systems." □

Physicist Jim Hines checks the accuracy of a service station air tower using the portable instrument he helped develop.

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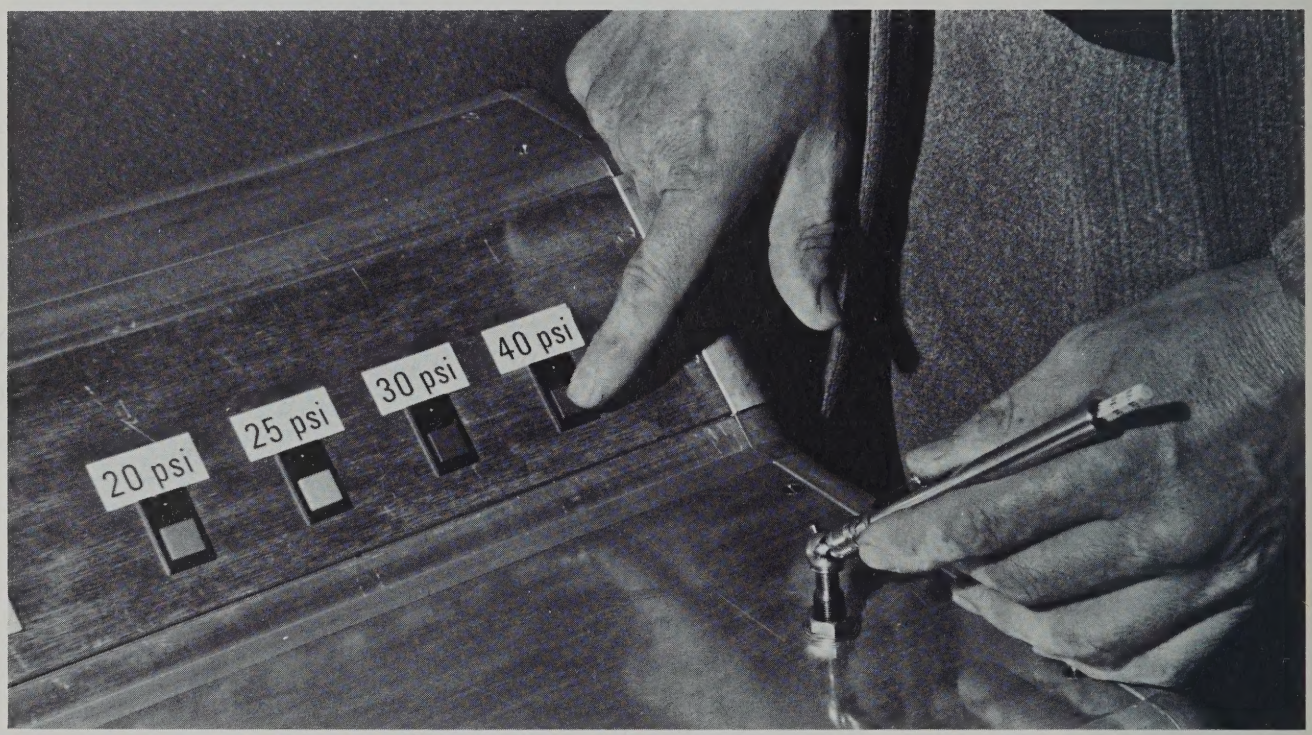
Tire *continued*



Designed for display at public exhibits and information centers, this automatic calibration system provides pressure accurate to 0.5 psi at one of four settings for the testing of tire pressure gages.

INFLATING TIRES THE METRIC WAY

The SI or metric unit of pressure is the newton per square meter (N/m^2). The unit is also called the pascal (Pa), after the 17th century French mathematician Blaise Pascal.

The torr, which measures pressure in millimeters of mercury at 0 °C, is roughly equivalent to 133 Pa; by comparison, 1 psi (pound-force/$inch^2$) is about equal to 6895 Pa. When measurements get that high, they are reported in units of a thousand, or kilopascals. The exact conversion is:

1 psi = 6.894 757 kPa

So a tire inflated to 28 psi has a pressure of just about 193 kPa, and one inflated to 32 psi is about 221 kPa. A good tire gage that is accurate to within 0.5 psi has an accuracy of 3400 Pa. In comparison, the accuracy of the NBS primary pressure standard in that range is about 20 Pa.

And if inflating your tires to the proper pressure improves your gas consumption by 1 mpg, you're saving 0.43 km/liter.

For tips on tire care see page 17.

Is There More Than One Way to Erase a Tape?

*by Sidney Geller**

COULD the following story be true?

An electrician walked into a computer tape library carrying a tool box. The contents of the box included a small magnet. By the time the technician left the room, he had unsuspectingly erased most of the valuable data stored on the tapes.

Those of us in the magnetic group heard a number of similar stories concerning the erasure of important recorded tapes by a variety of devices, including radars, metal detectors, and x-ray surveillance devices which are used in airport terminals.

To determine the validity of these and related concerns, we in the Institute for Computer Sciences and Technology, as a part of our programs in magnetic media measurement and computer security, set out to discover what methods could actually be used to destroy data on a computer tape. Although computer tapes, cassettes and magnetic stripe credit cards were used in the tests, the results can be applied to many other computer magnetic storage media, including rigid disks or drums, because most of the magnetic surface coatings are similar.

Among other measures, we bombarded the tapes with x-rays, subjected them to microwaves in a microwave oven, put them in a gamma ray pool, exposed them to radar signals, heated them, froze them, and placed them inside of color television receivers. Based on our tests, we maintain that there is virtually only one way to erase a tape: use an intense magnetic field at close range.

This and other conclusions, along with recommendations for safeguarding data, result from the experiments which I will briefly describe:

Magnets

In one test series, recorded computer tapes which were stored side by side in their normal vertical position were approached on their outside flange edges by a powerful but concealable horseshoe magnet. The results of this test—which had considerably greater potential for data erasure than the small magnet in the tool box—were as follows:

When erasure occurred, the maximum erasure always took place on the layers of tape closest to the magnet and lessened as the distance from the magnet increased. The explanation is that the magnet field strength decreases very rapidly with distance from the magnet.

The magnet was first placed 11 mm (0.44 inch) from the outermost layer of the tape. On playback, the tape showed a decrease in signal strength at the beginning by as much as 80 percent from the normal level (the signal represents data*). All information on the first 107 m (350 ft.) of the tape was lost. At 107 m the signal, which increased gradually with distance, reached 50 percent of normal, level, indicating that the data were recoverable from that point on.

When the same magnet was moved away to only 25 mm (1 inch) from the edge of a recorded computer tape, the greatest reduction in the signal

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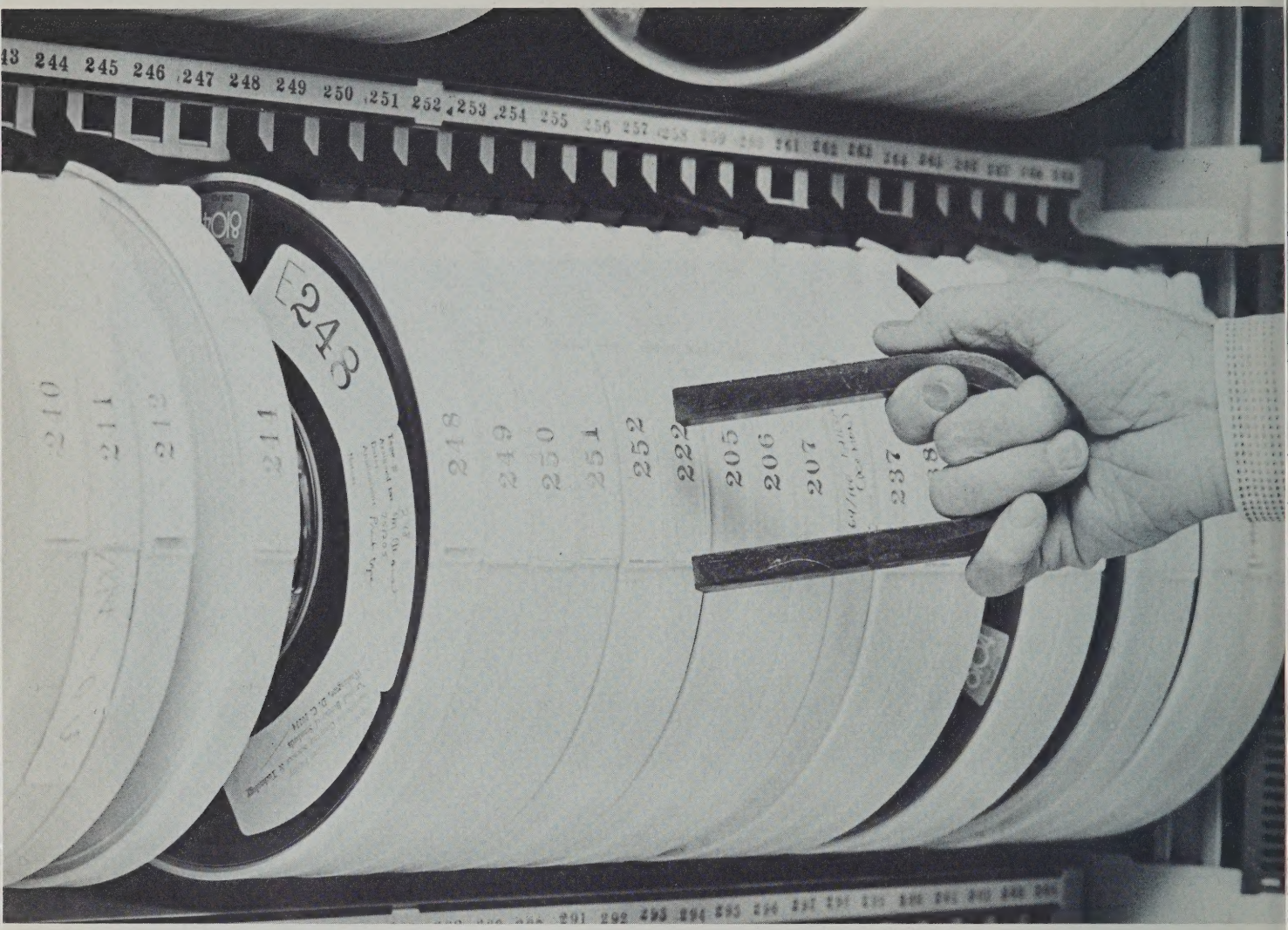
*Sidney Geller is the manager of the Magnetic Media Group in the NBS Institute for Computer Sciences and Technology.

*Data on a recorded magnetic tape take the form of magnetized regions which are converted into electrical signals on playback. These signals can decrease in strength by as much as 50 percent without impairing the ability of the computer to detect them clearly. No information is lost up to that point. Without monitoring changes in signal strength as well as data damage, the researchers would have been unable to quantify how much—if any—effect the phenomena under study had on the tapes.



At this proximity, a powerful horseshoe magnet will cause significant damage to the data on a computer magnetic tape.

level was only 22 percent and there was no loss of information. At a magnet-to-tape distance of only 51 mm (2 inches), there was no measured decrease in the signal strength.

These results show that the stories of severe data losses from the mere presence of a permanent magnet are not true. However, undetected sabotage is possible and controlled access to tape vaults should be maintained. It was also found that the duration of exposure of a tape to a magnet has no observable effect on the degree of erasure—the maximum erasure damage is done instantaneously or not at all.

Other Magnetic Fields

Tests were performed with varying magnetic fields such as those that are produced by electric motors, generators, and transformers. It was found that these varying fields will cause no data erasure even at very close range if the devices are encased in their normal metal shields. The erasure produced by a varying magnetic field depends on the peak strength the field achieves as well as the closeness of the media to the device.

In airport terminals there has been suspected damage or erasure of data signals on magnetic computer tapes which are passed through metal detector and x-ray surveillance devices. Airport radar signals have also been claimed as a threat to magnetic computer media.

In order to determine whether potential hazards to the data really existed in these areas, a series of tests was performed at Dulles International and Washington National Airports and the NBS Radiation Physics Laboratory. Recorded tapes and cassettes were subjected both to airport surveillance x-ray dosages and then to extreme dosages at NBS. There was no loss of signal level measured in any exposed tape.

The recorded tapes were walked through a number of different types of metal detectors at both airports. In normal operation, these units subject objects to low intensity, low frequency magnetic fields. Computer tapes and magnetic stripe credit cards were also placed into direct physical contact with the smaller hand-held airport metal detector units. Neither the large walk-through nor the hand-held detectors caused any measured decrease in data signal level.

In order to test the effects of radar signals, recorded tapes were brought to a radar installation operated by the Naval Research Laboratory. They were placed as close as 3 m (10 feet) within the focus of powerful stationary antennas of different types. Once again, the recorded tapes proved to be resistant and showed no decrease in signal level.

More Tests

The airport tests were followed by another series of varied experiments:

- Recorded tapes and cassettes were taken to the NBS High Voltage Laboratory and subjected to intense electric fields. In addition, arcs were struck onto the magnetic stripe of pastic credit cards by ignition coils;
- Recorded media were subjected to gamma ray doses of 3.0 megarads for 1½ hours in the NBS gamma ray pool;
- Recorded magnetic stripe credit cards were subjected to a load of 900 kg (2000 lbs);
- Recorded media were placed against all of the electrically operating components in the engine compartment of several automobiles;
- Recorded cassettes were placed into the interior and exterior regions of several color television receivers;
- Magnetic stripe credit cards were subjected to temperatures up to 182 °C (360 °F) and temperatures as low as –51 °C (–60 °F);
- Recorded tapes were irradiated by microwaves in a microwave oven (not to high temperatures); and
- Recorded media were exposed to intense infrared and ultraviolet light.

These tests caused no erasure and strongly indicated that the magnetically recorded data on computer magnetic storage media are resistant to almost all forms of energy except for intense magnetic fields at close range. Therefore, methods for detecting the presence of magnetic fields near the tape vault areas should be considered as a data safeguard. For example, relatively inexpensive walk-through magnetic field detectors are available.

The tests showed that there is no need to shield the data stored on magnetic media against x-rays, high voltage fields, nuclear radiation, high frequency fields, or light energy. They also showed that a spacing of three or more inches will protect the recorded data from very intense magnetic fields which are considerably stronger than those which will ever be encountered in a normal operating environment. □

SECURE SYSTEMS

The widespread use of computers and associated storage media in government and industry was a factor that led to laws such as the Privacy Act of 1974 (Public Law 93-579) which provide one basis for Federal government requirements for secure computer systems. A secure system is one in which the confidentiality of data is protected against unauthorized modification, use, or disclosure and one in which data are also protected against accidential or intentional destruction.

To date, ICST has initiated efforts which have led to three computer security guidelines in the form of Federal Information Processing Standards Publications (FIPS PUBS) and to an encryption algorithm for thwarting illegal access to computer data.

The study of the effects of various environments on the integrity of stored data on magnetic media which is described in this article has appeared in two publications* and will eventually be incorporated in a guideline publication. This guideline can be used by computer installation managers for making decisions about the optimum handling and storage of the recorded magnetic media.

*"The Effects of Magnetic Fields on Magnetic Storage Media Used in Computers," NBS Technical Note 735, July 1972 and "Erasing Myths About Magnetic Media," *Datamation*, March 1976.

How Fares the Mobile Home

In Wind, Fire, Energy Use?

by Frederick P. McGehan
NBS public information specialist

MANY Americans today cannot afford to buy a home. Or can they? House seekers in impressive and growing numbers are finding a solution to the problem of price. It's called a mobile home. In fact, approximately 19 percent of the buyers of new, single-family homes chose this alternative in 1975. Six million Americans have already taken up residence for a comparatively modest investment—usually under $20,000.

Factors other than finances have helped elevate the lowly "trailer house" to the status of a middle class dwelling. Mobile homes are factory built and inspected and "appointed" to be both convenient and attractive.

But are they sturdy and are they safe and how efficiently do they use energy?

These are among the questions of concern to owners and manufacturers, to potential buyers, to private standards-making groups, to building officials, and to the federal government. And this concern seems to be well founded, especially in an area such as fire safety. Fire strikes a mobile home no more often than it does a conventional house. Yet fire damage has been three to five times greater for the mobile home, in loss of life and property, than for a conventional site-built home.

A range hood over burners in mobile home kitchens will reduce substantially the chance of overhanging cabinets igniting, NBS researcher Edward K. Budnick found.

(Photos by Mark Helfer.)

Such conditions can be remedied. The Department of Housing and Urban Development (HUD), at the direction of Congress, took the first step toward improving overall performance when it issued Federal Mobile Home Construction and Safety Standards that went into effect in June of this year. HUD developed the initial standard, basing it in large measure on earlier efforts by the National Fire Protection Association and the American National Standards Institute. The agency will continually revise and update the regulation as part of the process of improving its effectiveness. The National Bureau of Standards, with a history of mobile home research and related standards development experience, has been called on to assist and advise in this effort.

Working through its Center for Building Technology and Center for Fire Research, the Bureau has focused on four major areas: fire safety, wind loads, energy conservation, and emergency egress (evacuation).

Fire Safety

NBS mobile home fire research began in 1974 and to date involves several branches of inquiry—kitchen range fires and fire spread in corridors, living rooms, and bedrooms.

Edward K. Budnick and David P. Klein of the NBS fire center completed a series of 28 full-scale tests to evaluate the potential fire hazards in the kitchen areas of mobile homes.* In each test a pan of cooking oil on the top of a range was allowed to overheat, thereby starting and spreading a fire. They found that without a range hood and a layer of inorganic insulation beneath the kitchen cabinets that overhang the range, there was a substantial chance for the cabinets to ignite. If these overhead cabinets began to burn, the fire next spread to other units and then to the wall and partition area behind them, allowing flames to break into the adjoining room.

As a result of these findings, Budnick and Klein recommended to HUD that a sheet metal hood backed by insulation be placed above the range with a minimum clearance of 60 centimeters (24 inches) from the burners. They also recommended limiting the flammability and combustibility of the exposed partition behind the range to prevent fire from penetrating into adjoining areas.

In addition, Budnick conducted 38 full-scale tests where a wood "crib" the size of a piece of upholstered furniture has been ignited to provide information on fire growth and spread with a variety of interior-finish materials.

Budnick found that a fire originating in a bedroom or living room area tended to enter the corridor connecting these areas and, instead of venting through the roof or side windows, to progress directly down the length of the corridor. This limited the escape possibilities, since one mobile home door is generally located along the corridor. Some of the wall and ceiling materials tested in the corridor produced excessive temperatures in less than four minutes.

As a result of these tests, Budnick recommended the use of improved materials for the wall and ceiling assemblies in the corridors. Such use "could significantly increase the fire safety for occupants and reduce the property losses from fires," he noted in a report to HUD.* Budnick's next step will be to test double-wide mobile homes for fire safety. Double-wides consist typically of two 18-meter (60-foot) long mobile homes joined together to make one large unit.

Emergency Egress

In a related research effort, Sanford Adler of CBT made a study of the egress provisions in the HUD standard. Using a typical single-wide unit, he cut holes in the sides to make room for emergency exit devices, mainly windows. Doors were not part of this study.

Adler then compared each of the devices with the provisions of the standard. He found that the standard did not adequately consider the characteristics of newly designed egress devices nor did it emphasize the primary objective of rapid, safe egress.

Adler assumed the "most critical need" for emergency evacuation to be during a night fire "when sleeping occupants of a mobile home are jarred awake by an alarm or by sensing the smoke, flame, or noise of a fire." He said in his report that means of escape should be located so that "all occupants physically capable of rational behavior can safely evacuate unassisted". The primary goal, he added, is egress, and he proposed the criterion that an egress device should

*NBSIR 75-788 "Evaluation of the Fire Hazard in a Mobile Home Resulting from an Ignition on the Kitchen Range" February 1976.

*NBSIR 76-1021, "Fire Spread Along a Mobile Home Corridor," July 1976.

continued on page 18

KEEPING HEADS

TOGETHER

FOR many Americans the word "helmet" is linked to certain occupations, like coal mining. But this single piece of equipment provides protection to people engaged in a variety of activities.

Many states now require helmets for motorcycle drivers and passengers. New safety regulations also require "hard hats" in a growing number of workplaces. And, of course, thousands of young Americans tighten chinstraps every fall in an American rite known as football.

Are these helmets doing the jobs for which they are intended? How do you test a helmet to find whether it "measures up" before experience provides the answer? Are there ways of designing such apparatus to get better protection, in the form, say, of greater impact resistance?

These are some of the questions being asked by government agencies such as the Consumer Product Safety Commission and by private standards-writing bodies like the National Fire Protection Association (NFPA). Some of the answers are coming from the National Bureau of Standards' Center for Consumer Product Technology.

NBS engineer Nicholas J. Calvano has spent the last two years testing helmets worn by firemen. He has found many of the designs "wanting" and has developed a proposed standard that will be transmitted to the NFPA through the National Fire Prevention and Control Administration. "For the first time many manufacturers may start producing helmets specifically to meet the very demanding needs of firefighters," Calvano says.

The proposed standard covers impact protection; penetration, heat and flame, and electrical resistance; and chinstrap strength. To test firemen's

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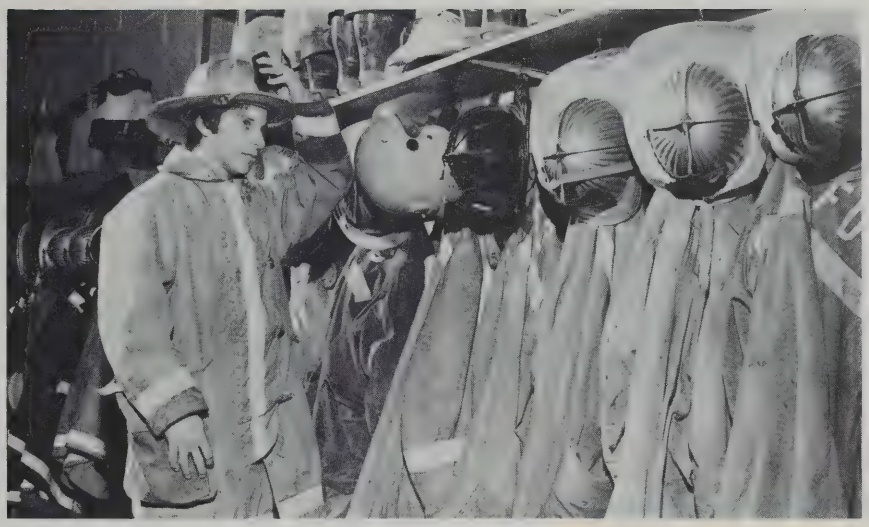


(Photos by Mark Helfer and David Sipple.)

Helmets in a Maryland firehouse.

Nicholas Calvano holds a flame to a modernistic fire helmet to test its fire resistance.

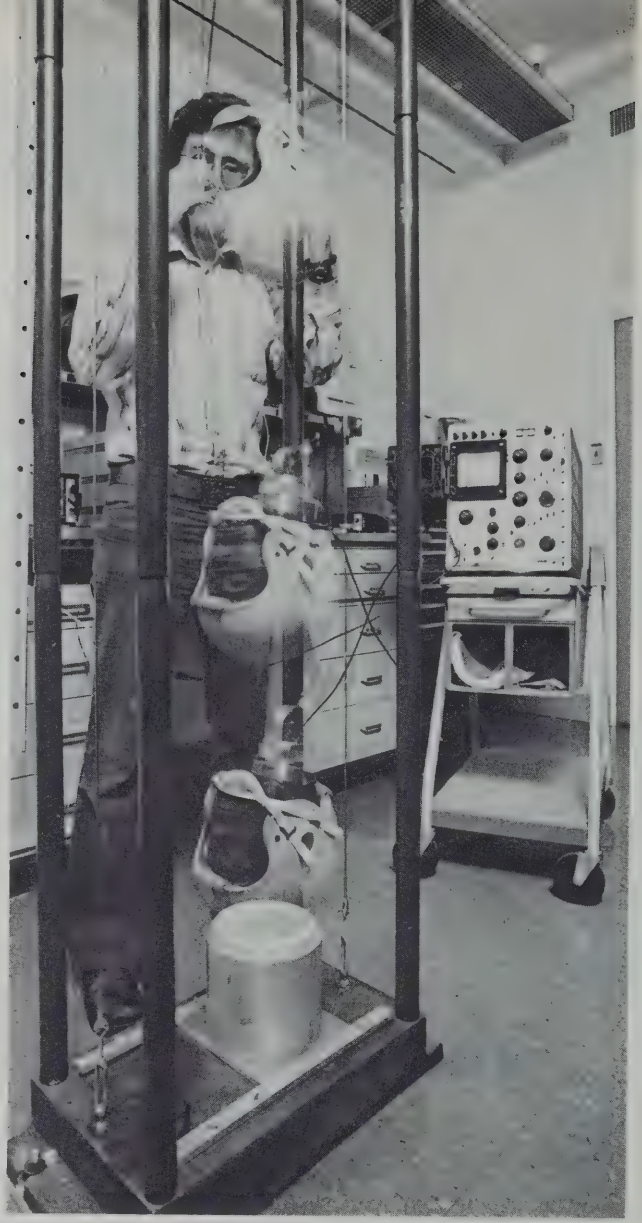
Heads *continued*

helmets against impact, Calvano places them on a headform and drops them 180 centimeters onto a solid steel anvil to produce an impact energy of 90 joules (66 foot pounds). This is similar to a 2.25 kilogram brick being dropped from a second story window. Calvano also uses facilities in NBS' Center for Fire Research to expose helmets to heat and flame.

If the NFPA adopts the proposed standard and manufacturers produce helmets to meet the requirements, the level of head protection for firefighters should increase greatly. This will contribute significantly to upgrading the safety of this nation's most hazardous occupation.

Calvano is also using a similar drop-test apparatus to participate in a series of round-robin tests with 10 other laboratories on football helmets. The object of the tests, sponsored by the American Society for Testing and Materials (ASTM) and Wayne State University, is to determine if the head form and the procedures required for testing football helmets are adequate. If a wide variance in test results is found, the standard may be altered.

F. P. M. □



Robert Berger operates a helmet drop test mechanism used in a study to develop test procedures for impact resistance.

The crunch of opposing football linemen making contact is a familiar fall sound. The victors in this October contest were the Orioles from the Maryland School for the Deaf. Their opponents were the Cardinals from the Virginia School for the Deaf. Such a confrontation takes its toll on equipment, particularly the helmets.

HIGHLIGHTS

Periodic Chart Revised

The latest revision of the *Periodic Chart of the Atoms,* published by the Sargent-Welch Scientific Company, will appear early next year. At the request of the publishers, NBS updated all numerical data for the chart and the accompanying booklet, using input from National Standard Reference Data centers. The first edition of the chart, which appeared in 1924, was based on a modernization of Mendeleev's table, designed by Henry Hubbard of NBS. The Bureau has contributed to each subsequent revision of the publication.

Accuracy of Radiation Doses for Cancer Treatment Being Studied

As part of a nationwide measurement-assurance study, NBS is investigating whether cobalt-60 teletherapy radiation doses are being delivered in the prescribed amounts. With the support of the Bureau of Radiological Health, NBS is mailing dosimeters for measuring such radiation doses to all therapy departments desiring to participate. It is expected that, by the time of completion of the study in October 1977, over 700 teletherapy units will have been tested, a selected group of them more than once.

Research Contributes to New Oregon Law

The State of Oregon has passed a law restricting the use of nonhydrogen fluorocarbon materials as refrigerants and spray-can propellants. Scientists at NBS and the National Oceanographic and Atmospheric Administration used laser spectroscopy to confirm that fluorocarbons containing hydrogen, unlike the nonhydrogen variety, may be purged from the atmosphere before they can damage the ozone layer. The results of this research were reflected in the Oregon law. Other states are considering similar legislation.

NBS Device Retrieves Deep-Ocean Organisms

Researchers at NBS and the University of Maryland have developed a unique device to probe the ocean depths in search of microorganisms important in marine ecology. The device has been used successfully to retrieve marine life from a depth of 6800 meters, an unusually difficult task because the high pressures and low temperatures encountered have to be maintained during and after retrieval. The instrument used is an aseptic (noncontaminating), deep ocean sampler. It is inexpensive, rugged, safe, as well as easy to use, and should prove a boon for research in this area, particularly for laboratories with limited fiscal resources.

"Newest" Interstellar Molecule Identified

NBS scientists have identified a new interstellar molecule, ethyl cyanide (CH_3CH_2CN), from correlations between laboratory and telescope data. Working from a collection of more than 50 observed telescope signals of unknown molecular origin, the team has now determined 11 transitions that uniquely fingerprint the ethyl cyanide molecule in Orion. Ethyl cyanide is the third 9-atom molecule detected by the NBS team and their collaborators and the largest nitrogen containing compound discovered thus far.

DIMENSIONS
The magazine of the National Bureau of Standards U.S. Department of Commerce
January 1977

GOOD DATA /See Page 6/

New Dimensions

DIMENSIONS will have a new "look" beginning next month to complement and accommodate revisions in editorial content and format. The magazine is being departmentalized to communicate more effectively with each segment of the Bureau's audience and clientelle. General articles intended to inform both the technical and non-technical communities will appear first, followed by departments aimed at more specialized audiences in science and industry.

Polymers Being Considered for Insulation

Researchers at NBS are investigating certain polymers for use as insulation in high voltage ac superconducting power transmission cables. The Energy Research and Development Administration is sponsoring development of such cables to improve the efficiency of electrical power transmission. The potential transmission capacity is so enormous that two 3-phase cables, each approximately 30 cm in diameter, could carry sufficient electricity from a remote nuclear power park to supply New York City. □

A Rational Framework for Organization of Building Codes and Specifications Proposed

Researchers at the National Bureau of Standards, Institute for Applied Technology, Center for Building Technology (CBT) have proposed a more rational framework to assist researchers and writers in changing and updating building codes and specifications.

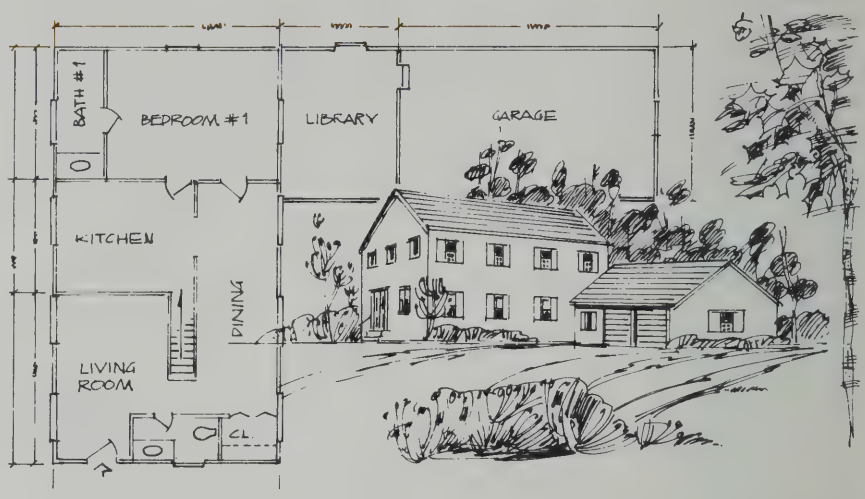
Codes and specifications have a major effect on the quality and cost of buildings. The CBT researchers believe there is a critical need to develop better processes for handling code additions and revisions to make them better serve the building community.

The work was performed by Steven J. Fenves of Carnegie-Mellon University while a guest worker at CBT, and Kirk Rankin and Hotchand K. Tejuja of CBT. Their pilot investigation is contained in "The Structure of Building Specifications," a publication of the NBS Building Science Series.

In their study, the researchers performed a detailed analysis of the Uniform Plumbing Code and the Interim Performance Criteria for Solar Heating and Combined Heating/Cooling Systems and Dwellings developed by NBS in 1975. These documents were chosen because they represent a good approximation of two extremes within code writing—prescription and performance.

From this analysis, the authors abstracted and derived basic principles of code formulation. These are organized into a guide for codes and standards writers.

As an example of this guide, the authors suggest the increased use of "properties" to encourage innovation in the performance approach to code writing. Properties appear in the wording of code provisions as modifying phrases. The authors cite a portion of the solar criteria that speaks of "assemblies containing heat transfer fluids . . ."



The authors note that such use of "property" in a code provision allows the writer to refer to any and all assemblies in any design which contains heat transfer fluids. This, they add, relieves the writer of the burden of listing all possible assemblies which might contain heat transfer fluids thus contributing to brevity and clarity in expression.

More importantly, they continue, the use of "property" provides the writer a way of referring to a class of assemblies without attempting an exhaustive listing of acceptable solutions, which might rule out unlisted new solutions.

In this same chapter, the authors suggest how individual code provisions should be organized internally and hierarchically within the complete code document.

Other chapters offer suggestions for reorganization of code classification frameworks. The report includes a bibliography of basic works and references on how codes are structured.

The effect of the suggested changes will be to reduce the time required to learn how one code differs from another. Currently, building component manufacturers, architectural and engineering firms, building contractors, and building regulatory officials spend much time searching applicable codes and specifications for the differences between similar provisions.

Printed copies of this publication, NBS Building Science Series, 90, may be ordered prepaid for $1.45 by SD Catalog No. C13.29/2:90 from the Superintendent of Documents, U.S. G. P. O., Washington, D.C. 20402.

Foreign remittances must be in U.S. exchange and include an additional 25 percent of the publication price to cover mailing costs. Order microfiche copies prepaid by NBS designation from the National Technical Information Center, Springfield, VA. 22161; the price is $2.25 (domestic) or $2.95 (foreign) a copy.

Workshop on Applications of Phase Diagrams Scheduled for January

The National Bureau of Standards will sponsor a three-day workshop aimed at stimulating production of more relevant and useful compilations of phase diagram data for alloys, ceramics, and semiconductors at its facilities in Gaithersburg, Md., on January 10-12, 1977.

The workshop will bring together metallurgists, ceramists, geochemists, solid state chemists and physicists, and materials engineers to discuss the need for reliable data on phase equilibria, approaches to such data compilation and evaluation, and alternative methods of publishing and distributing the results. Attendees will include those people involved in evaluation and compilation of such data as well as users of the data.

Knowledge of the structure of materials is important in understanding many industrially significant properties and applications such as aging, hardness, occurrence of brittle intermetallic compounds, magnetic transition temperatures, high temperature solubility of impurities, and corrosion resistance. The study of a phase diagram appropriate to a particular material can often provide information important to its scientific and technical applications.

The workshop will include discussions about how to identify resources that are now being expended that could be made more useful by coordination and suggestions for areas of international cooperation. A number of distinguished scientists from countries other than the United States will be participating.

The program will include panel, tutorial, and poster sessions. There will be ample time for informal discussions.

The workshop is sponsored by the NBS Institute for Materials Research and the Office of Standard Reference Data. Persons interested in receiving additional information about the workshop should write to Ronald B. Johnson, Materials B348, National Bureau of Standards, Washington, D.C. 20234.

TIPS ON TIRE CARE

Proper inflation is the most important rule in tire safety and tire mileage. Follow the recommended pressures given in your car owner's manual or on the instruction sticker in the car.

Tire inflation should be checked every few weeks, particularly before long trips, by using a clean pressure gage in good condition. Check the pressure when the tires are cool, before use, since pressures can increase up to 6 psi or more when tires are hot from driving. For sustained driving at high speeds, tires should be inflated 4 psi over the "cold" pressure shown in the tables, but not exceeding the maximum pressure rating found on the sidewall of the tire.

The 1970 NBS tire use survey found that vehicles in accidents have a larger number of severely worn tires on the rear than on the front, suggesting that it is safer to put newer or less worn tires on the rear.

Useful information on the selection and maintenance of tires may be found in the *Consumer Tire Guide,* published free of charge by the Tire Industry Safety Council. Copies may be obtained by sending a stamped, self-addressed envelope to the Tire Industry Safety Council, Box 1801, Washington, D.C. or by asking the Consumer Information Center, Pueblo, Colorado, 81009 for publication No. 504-E.

Another helpful publication is *Tires, Their Selection and Care,* part of the NBS Consumer Information Series. It is available for 90 cents from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

NBS engineer Bradley A. Peavy, Jr., used a variety of sensors to study the thermal performance of a mobile home in NBS' environmental chamber.

permit 95% of all mobile home occupants to get out safely within 30 seconds. Adler also suggested a list of safety requirements, such as latches that cannot be opened inadvertently by small children.

Wind Studies

Next to fire, wind is a primary cause of death, injury, and property damage in mobile homes. The problem is complicated by the fact that local terrain and nearby buildings can have an effect on wind speed and turbulence. In addition, the smaller size of mobile homes makes them more sensitive to wind gusts than are conventional low-rise buildings.

To undertake wind-load studies, Richard D. Marshall, a structural research engineer in CBT, placed a typical, single-wide unit on a turntable apparatus in an asphalt parking lot at NBS headquarters in Gaithersburg, Md. The turntable was used so that the researchers could take advantage of wind blowing from any direction.

The home was fully instrumented to measure horizontal (drag) and vertical (lift) forces. In addition, more than 100 holes were drilled in the sides, roof, and floor. Sensitive instruments were placed at these points to measure wind pressure. A data acquisition system was programmed to trigger automatically when wind gusts exceeded 15 meters per second (34 mph). A supporting system of steel beams and columns simulated an actual mobile home installation, which included diagonal and vertical tie-down cables.

The first wind measurements were taken in January and continued until May 20, 1976. During the tests, wind gusts reached 30 m/s (67 mph). Marshall calls the work the "most comprehensive set of windload meas-

The small size and location (such as on a hill) of mobile homes can make them more sensitive to wind gusts than conventional low-rise buildings

urements ever made on a low-rise building."

Although he has not completed his analysis of the multitude of data, Marshall believes the original wind design loads proposed by HUD are fairly adequate with some increases required in the uplift loads. Also, loads for the design of exterior paneling, doors, windows, and roof overhangs will be recommended. He found no problems with resonance—the natural swaying of structures in wind, especially notable in some suspension bridges and high-rise buildings.

The last phase of Marshall's work involved the use of hydraulic rams to apply simulated wind loads on the sides and roof of the test home. Loads corresponding to wind speeds of 42 m/s (94 mph) were attained. At this extreme there was some buckling of the end walls and some separation at the roof-wall connection. To safeguard against extreme wind speeds, Marshall suggests increasing the number of tie-downs passing over the top of the mobile home. He would like to see the extra straps placed near the middle of the structure.

Energy Conservation

In another important research area, CBT engineers studied the thermal performance of a new mobile home in an environmental chamber. The chamber can simulate extremely hot or extremely cold weather conditions. Researchers found that the heating plant in this home was "considerably oversized" and thus inefficient and unnecessarily expensive to operate. The system was designed to maintain interior comfort when outside temperatures were as low as minus 46 degrees Celsius (minus 50 °F). This was much lower than temperatures found in the marketing area for the mobile home. It means the heating plant will operate less frequently during the winter heating season, reducing the plant's efficiency because of heat losses that occur when the plant is not operating.

The CBT engineers used an infrared television camera to identify air leakages in the home. "Through this analysis, it was determined that, under low outside temperature conditions, convective air currents occurred within the insulated walls, reducing their efficiency," the CBT researchers stated in a report prepared for the Federal Energy Administration* The cause of the air flow was, in part, poor installation of the insulation. They recommended that "carefully fitted, full-thickness insulation be used. . . ."

Pressurization tests were also undertaken to identify air-flow paths as sources for potential air leakage. These tests showed that 40 percent of the pressurized leakage occurred through the walls—most of it because of the specific wall-window construction used in this mobile home. Furnace flue and bathroom exhaust vents were found to be poorly sealed, resulting in excess leakage. The engineers also found unsealed penetrations through the ceiling that allowed moisture-laden interior air to rise into the attic space, resulting in excessive condensation under high interior-moisture conditions.

The CBT researchers recommended that future modifications of construction and safety standards for mobile home take into account some of their energy-related findings. Specifically, they recommended that a limit be placed on furnace oversizing in order to increase seasonal efficiency; that the insulating effect of draperies, cupboards, closets and similar items be included in standard calculation procedures for heat loss or gain under design conditions; that full-thickness insulation be used in walls and its installation be done carefully, and that methods be included to reduce air leakage paths and reduce the potential for condensation within the attic.

All of the results of NBS mobile home research are being funneled to the Department of Housing and Urban Development for its use in evaluating the new mobile home standard. As HUD weighs and considers these findings and recommendations, NBS continues to provide technical input to the decision-making process. □

*NBSIR 76-1063 "Air Leakage Measurements in a Mobile Home"; Hunt, Treado, and Peavy; July 1976.

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